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Journal of the Society of Arts.

FRIDAY, MAY 6, 1859.

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EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 25th ult., and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

CONVERSAZIONI.

The Council have arranged for two Conversazione during the present Session; the first, to-morrow (Saturday), the 7th inst., at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th inst., at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman. Cards for each of these evenings have been issued. Members who have not received them are requested to communicate with the Secretary of the Society of Arts.

The articles to be exhibited at the Conversazioni to-morrow evening, will remain at the Society's House during Monday, for the inspection of members and their friends.

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date :—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Dr. Skey	1	1
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

TWENTY-FIRST ORDINARY MEETING.

Wednesday, May 4, 1859.

The Twenty-First Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 4th inst., Thomas Chapman, Esq., F.R.S., Chairman of the Committee of Lloyd's Register, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Carey, Stephen
Ellison, Thomas
Haywood, G. R.
Holder, Joseph
Jones, Charles
Wilson, William Newton

The Chairman regretted he seldom had an opportunity of being present at the interesting and highly useful meetings of this Society, and his only claim to the honourable position of presiding on the present occasion was, that he had for upwards of twenty-four years been chairman of the Committee of Lloyd's Register of British and Foreign Shipping; he had therefore been invited to undertake this duty, a request with which he had had much pleasure in complying. As he believed allusion would be made in the course of the observations that would fall from his friend, Mr. Wray, to the Society of Lloyd's Register of British and Foreign Shipping, he thought it desirable that he should state very briefly what were the objects of that society. Previously to the year 1834 there existed in England only two register books for the purpose of giving to the public a classification of British shipping. The means they adopted were by no means adequate to the end they proposed, as would be understood when he stated that they assigned a character to ships, not according to the description of material of which they were composed or the mode of construction, but according to the place at which they were built. There was a term familiar to all present—that of a ship standing "A 1 at Lloyd's;" but the precise meaning of that term, or the means by which the character of A 1 was obtained, might not be generally known. As he had said, the former society to which he had alluded gave the classification to ships according to the place at which they were built. To those built in London they assigned the character of A 1 for twelve years; at Bristol, eleven years; at Gloucester, ten to eleven years; whilst, in the north of England they only assigned the character of A 1 for a period of seven or eight years. It would thus be seen that there was no inducement for the north of England to build good ships, while there was every inducement for the south of England to build bad ones. The institution over which he presided—the Committee of Lloyd's Register—was formed for the purpose of correcting this evil, and the principle they had adopted was to assign the character of A 1 according to the materials of which the ships were built, and the manner in which they were constructed. The committee took means for obtaining the best information they could as to the durability of the various kinds of wood used in the different parts of a ship. Thus, to the higher classes of wood was assigned a period of twelve years; to those of lower quality, ten, nine, eight, or seven years; and to the the lower American woods only four years, for the character of A 1, while the position in the ship of the various kinds of material, and their liability to exposure to the different elements materially affected its character. The Society of Lloyd's was one of great importance not only to the mercantile marine of the country, but also in a national point of view. He was sure the people of this country felt no deeper interest in any subject than in our national defences; and, therefore, any observations that might fall from his friend Mr. Wray, tending to afford information as to the means whereby we could

procure timber for ship building, would be of the greatest interest, for it would be allowed by all that nothing was more important to the welfare of this country than upholding "the wooden walls of Old England."

The Paper read was—

ON TIMBER FOR SHIP-BUILDING.

By Leonard Wray.

As the greatest maritime nation in the world, England is infinitely more interested in the subject of ship-building than any other country; and any information—any suggestion—tending to benefit that great national interest, must have a certain importance in the eyes of the community, from the very magnitude of the subject involved, however humble the individual may be who ventures to offer it.

It is *this* belief that has induced me to travel so far out of my own particular pursuits as I have done, in undertaking to present this paper to the notice of the Society of Arts; and if, from the varied experience and observation of my life, I can bring to bear upon this subject any useful facts, and can offer any practical suggestions, I shall esteem my present effort as being a very happy and a very grateful task.

From time to time during my life I have had a great deal to do with a number of the principal timber woods of Europe, Asia, Africa, and America, which are known and classed by the timber-merchants and ship-builders of Europe; and I may moreover say, that I am very fairly acquainted with several timber woods which are almost wholly unknown in this country.

With such a knowledge of these timbers, I have long been struck with the fact that, when used in the construction of ships, their accredited durability seems woefully at variance with that which we find possessed by the same descriptions of woods when they are used in various ways on shore. Timber, which has the reputation of remaining perfectly sound for one hundred (and even for *several* hundred) years, in various structures, such as noblemen's mansions, churches, cathedrals, and other ancient public edifices, has no such high and flattering estimate placed upon it when, for the purpose of ship-building, it is brought under the rigid classification of that deservedly great and potent body known all over the world as "*Llcyd's.*" On the contrary, we find, in the "Rules and Regulations" of that association, these self-same descriptions of timber classed no higher, in any case, than thirteen years (in the first instance), even with all the well-defined advantages of copper fastening, and other requirements, indispensable in a first-class ship! True, this term may be renewed for a further period of five years (being eighteen years in all) by thoroughly opening up the ship, from stem to stern, for a critical survey; and by making all those alterations, additions, and improvements in her hull and rigging, which the surveyors may think necessary, to effect a genuine and complete "*restoration;*" but this "*restoration*" is in general so troublesome and so expensive a course, that in nine cases out of ten the owner had better build an entirely new vessel than have recourse to it.

A ship being once off the first letter at Lloyd's, very rapidly runs down the scale of her classification, unless kept up to a certain letter by constant surveys and expensive repairs: but through these I do not purpose following her.

We have had instances, and those tolerably numerous, of ships, constructed of teak, mahogany, and even oak, lasting for a very long series of years, and being comparatively sound in their timbers when wrecked or broken up. On the other hand, cases are by no means rare of vessels, built even in the Government dock-yards, being—so to speak—unsound from the day they first entered the water. Indeed we can recal instances, and might give the names, of men-of-war which were said to be thoroughly rotten before they were ever launched!

These speaking facts, exhibiting as they do such startling contrasts, and bearing so seriously upon one of the most important of all questions to us, as a great maritim nation, may well arrest our attention, and demand an earnest unprejudiced investigation.

No sane man will, for a moment, call in question the justice or wisdom of those rules established by Lloyd's for the building and classification of ships; for the experience of more than 120 years guides them, and the telling events of each succeeding day add their testimony to confirm the lessons of the past. The very rock upon which that noble association is founded is—"experience;" turned to practical account by the clear heads and comprehensive minds of its leading members. That such a body should originate, or even suggest, experiments, is entirely foreign to its character and to its vocation; but, when independent enterprise has fully tested and proved a case bearing upon the construction of ships, it is then for Lloyd's, acting upon the experience so gained, to adopt and sanction the improvement or alteration, if they deem it worthy of that attention.

But in saying this, I nevertheless feel convinced that any useful and judicious experiments, tried by individuals, would always be fairly viewed and fairly encouraged by Lloyd's.

I have already said that the subject of ship-building embraces one of the most important questions we can possibly discuss; and to recognise this we need only refer to the Official Reports on the Merchant-Shipping of the United Kingdom; leaving our Royal Navy to be spoken of hereafter.

According to these Reports we find that we had:—

In 1854, of sailing and steam vessels 17,407, manned by 162,416 sailors, and amounting to 3,729,093 tons.

In 1856, of sailing and steam vessels 19,270, manned by 176,387 sailors, and amounting to 4,211,482 tons.

In 1858, of sailing and steam vessels 20,071, manned by 177,832 sailors, and amounting to 4,325,242 tons.

This last amount of tonnage must, I presume, represent a value of upwards of thirty-five millions sterling, upon which we may safely place an annual depreciation and loss of from ten to fifteen per cent.

But if we add to this the value of our Royal Navy, with its annual depreciation and loss, we shall gain some idea of the extreme magnitude of this question.

Timbers Used in Ship-Building.

According to Lloyd's classification of timbers, we find that *first class* comprises only the following:—

The English and the African oak, the live oak of America, the mora and greenheart of Guiana, the teak and saul of India, and the iron-bark of Australia—being eight in all—of which number America supplies three; India, two; and Europe, Africa, and Australia, only one each.

These timbers are all close-grained and compact; hard, strong, heavy, and durable, being more or less naturally impregnated with certain oily, resinous, or astringent matters. The oaks (containing an acid and an astringent principle) are indubitably more liable to "rot" than the other named woods, which abound in oily or resinous matter; hence we find ships built of the best English oak, frequently destroyed very speedily by "dry rot." I do not, however, say that even a wood so abounding in oil as the teak, does not occasionally exhibit decay;" on the contrary, experience has shown that this timber sometimes does so to an unexpected degree. On this point, however, I must beg of you to remark, that the varieties of teak are numerous, and that the character of the wood is very materially influenced by the peculiarities of climate, soil, and seasons in the locality from which it is obtained. Thus, we have the (finest description of) teak from Malabar; that from Travancore, from Ceylon, from Java, from the Malayan Peninsula, from the Burmese territories, and from the Tenassarim provinces. Of all these the Burmese and Tenassarim varieties are held to be the most inferior, simply because the great proportion of that shipped both at Rangoon and at Maulmain is timber grown on the rich, low, alluvial soils formed by the great rivers on whose waters they are eventually floated to market. In justice, however, to these ports of supply, I must state the fact that, both in Burmah and Tenassarim, the quality of teak, as a matter of course, varies according to the locality and soil on which it is grown; And we may therefore very fairly class the timber obtained from them as being good, better, and best. We find teak grown on high, dry, and open land of a fine quality, being closer and more compact, and abounding in a mild, bland oil, which scarcely affects the iron bolts that may be driven into it. Whereas that grown in the dense forests of the wet, low-lying, alluvials, is lighter, coarser-grained, and contains an acrid oil, which not only affects iron very materially, but even, to a certain extent, poisons and inflames the hand which has been pierced by its splinters.

We find, also the weight and consequent specific gravity of teak varying in a most remarkable manner, viz., from a minimum of ·583 to a maximum of 1·056 (according to the experiments by Mr. Seppings); although for all practical purposes we may take the range to be from ·600 to ·750.

You are all, of course, aware that differences in situation and soil create corresponding differences in oak, in elm, and in all other English timber woods; but because teak happens to have its *habitat* in the "nethermost parts of the earth," this simple law of nature seems to be overlooked by all, save by those few who have made these subjects their especial study.

The greenheart, the mora, the saul, and the iron-bark, have likewise their differences, both of kind and locality, but they are by no means of so important a nature as to demand the same marked notice as I have taken in respect to the varieties of teak.

These eight descriptions of timber hold, then, a very high and deserved character from Lloyd's classification; for with either of them may a first-class ship be built without the admixture of any other wood.

But upwards of twenty other kinds of timber are permitted to be used, in certain specified portions of a first-class chip; and some of these, at least, are no doubt working themselves up into a place amongst the highest class woods.

At first sight it may appear somewhat harsh, and even unreasonable, to place such a magnificent timber as the mahogany in the category of second-rate woods, the more so as we have had many well authenticated instances of the extraordinary strength and durability of ships built almost entirely of mahogany; amongst which I may mention the oft quoted case of the Spanish 80-gun ship named Gibraltar, captured by the English in 1757, and broken up at the age of 100 years when all her timbers were found to be perfectly sound. But we must, in relation to these particular cases, bear in mind two circumstances which are in themselves all important, viz., that in the first place, only the choicest and most superior description of mahogany was employed by the Spanish government in the construction of the Gibraltar (which was built at the Havannah), and that no expense whatever was spared in the selection. Secondly, that such a selection of choice mahogany for the entire construction of a merchant ship at the present day would be far too expensive to suit even our princely shipowners; whilst I need scarcely add that "swamp mahogany," or, indeed, any of inferior quality would be highly unsafe, and, consequently, inadmissable for the "timbering" of a ship, however far it might be allowed for "inside" and "outside planking," &c. What the crown of Spain so wisely did in days of yore, has been, in my estimation, wisely imitated but a few years since by our own Government in the case of the Queen's beautiful steam-yacht the Victoria and Albert, which is, I believe, almost wholly constructed of choice mahogany, and may, with ordinary care, continue in existence long enough to carry in pleasure and in safety her Majesty's great-great-grandchildren.

In ships of war, it is evidently extremely desirable to attain the highest possible range of durability; for in the peculiar circumstances of ships built for the Crown and of those built for the Merchant Service, there is this wide difference, that the former know not Lloyd's or its underwriters, whereas, the latter must "live, move, and have their being" according to Lloyd's, or that great body would certainly not know them or insure them.

"Mahogany of hard texture" is, however, so far admitted in the construction of A 1 ships as to include beams and hooks, knees, rudder and windlass, main pieces, outside planking to light mark, and the whole of the inside planking.

As there is a pretty general misconception in respect to the specific gravity of this wood, I may observe that "superior northern Honduras" is as heavy as Travancore teak, and even heavier than Malabar teak, or English oak; the inferior qualities of mahogany alone being so very light and buoyant.

I should be very pleased to see good mahogany enter more largely than it now does into the construction of ships; but I am persuaded that its more extended employment must be regulated with judgment and discrimination. In fact the diverse requirements of a ship's timbering and planking always recal to my mind the combination of woods employed in the construction of a West Indian buggy or cabriolet, viz.:—Calabash for the naves of the wheels, brazilletta for spokes, casshaw (or acacia) for felloes, cedar for the body, and lancewood for the shafts. The aim of the shipowner is to obtain lightness, strength, and durability; but whether he attains that object by employing one description of timber, or by a judicious combination of two, three, or more woods, is more often decided by the state of the timber market, and the balance at his banker's, than by scientific reasoning or his own innate convictions.

It is the merchant-prince and great shipowner who can carry into effect the conceptions of his genius, and who launches upon the ocean those magnificent specimens of naval architecture which are remarkable alike for their size, strength, lightness, capacity, accommodation, symmetry, beauty, and speed.

Go to the great building-yards of our Brocklebanks, Greens, Smiths, Wigrams, Dunbars, and others of like stamp, and there we shall see and be able to understand how gloriously that happy combination of wealth, practical experience, and intellect, work, in maintaining the proud position of our mercantile marine.

As may well be supposed, the cost of first-class woods is high, and the supply is not at all times equal to the demand; it is desirable, therefore, to know how the supply can be largely increased, and the cost considerably diminished. It has been justly observed by Mr. Labouchere, that every British subject in the United Kingdom has a material interest in the cheapening of timber, and I think that the remark very forcibly applies even to ship-building timber alone. I will endeavour to show you how this cheapening may be effected by opening up new sources of supply, as well as by taking a greater advantage of those sources already open to us.

But previously to entering on that part of my subject, I must not omit to notice the silent but rapid revolution which is taking place in ship-building for the merchant-service.

This is not only in the increased and increasing proportion of iron used in the bracing, strengthening, and general framework of ships, but in the decided preference which even the most cautious men are gradually showing for ships built wholly of iron. Ships have been built comprising full fifty per cent. of iron, but such half-measures do not seem to satisfy the minds of men now.

Those very men, whose habitual caution and abhorrence of all innovations would have made them, but a few years ago, look with contemptuous pity upon the adventurous being who could be so deluded as to own an iron-built sailing ship; who regarded those sad fellows—the Scott Russells, the Ditchburns, the Mares, and others of that school—as being the mortal incarnations of the Tempter; yes, some of the self-same cautious, knowing gentlemen, no longer look with disfavour upon iron ships and their go-a-head projectors; but having fully digested that monstrous innovation, even permit themselves to contemplate the possibility of adding to it "auxiliary" power. And well it is for such men that they can be convinced; otherwise, in the great and eager race of competition, they would be left behind, and others—less cautious, less timid, but less prudent—would outstrip them.

The great cause of "iron versus wood" is not, however, yet gained; the triumph may still be long in coming! The disastrous influence of iron upon the compasses—the treacherous character of iron plates and iron rivets—the pertinacious partiality of barnacles for iron bottoms! All these still exercise great influence upon many minds; but last, and above all, it is not the habit of our sturdy, sure-going countrymen to make any great change in a hurry.

A good and successful commencement has nevertheless been made, the ball is in motion, and onward it must inevitably go.

I do not hesitate to declare my own full belief, that the compasses will traverse correctly,—that both plates and rivets will prove steadfast, firm, and faithful, and even that the "barnacles" may be effectually kept off—yet, I should not wish to see so great a change progress otherwise than calmly, carefully, and safely;—which it can only do under the guidance of further experience and the practical success of many years.

As I have expressed my belief in the undeniable suitability of iron ships for mercantile pursuits, I must at the same time state my opinion against them, if applied to warlike purposes.

Next to the entire non-existence of a navy, I can conceive nothing so perilous to the interest and safety of this country, as having our ships of war constructed of iron; nor can I, at present, conceive how the inventive faculties of man,—aided by all the science of the age,—can afford any adequate safeguard against the disastrous liabilities of a thin iron structure, such as a ship exposed on the ocean to the terrible effects of a cannonade.

It is quite probable, and indeed almost essential, that the partial use of iron in the construction of men-of-war, should be very largely extended, as it would add considerably to their strength, lightness, and internal dimensions, but, notwithstanding this increased and increasing employment of iron, I do not see any likelihood of the demand for ship-building timber abating for many years to come;—on the contrary, I fancy that I can distinctly foresee a very enormous increase for the purposes of our navy alone; not merely for the contemplated addition to and conversion of our war-ships, but for the continual building of new ones, to replace those which are now being converted into screw steamers.

I hold it as the inevitable result of such "conversion," that dry-rot will make swift havoc amongst them, unless the only preventive measures possible have been timely effected; but as I shall have to refer to this important point again, we will now return to the more immediate matter from which I digressed.

INCREASED SUPPLIES OF SHIP-BUILDING TIMBER.

It is not sufficient that we discover forests of timber, even of the finest quality; for before they can be turned to profitable account, we require a population to fell and trim the timber, a good shipping port, and the cheapest possible means of bringing the timber from its native forests down to the port of shipment.

But we require even more than this, in the majority of cases, viz., a climate, such as the European Superintendents can not only exist in, but be able to expose themselves in, with some degree of impunity. As a summary then, we may consider to be essential: 1. A tolerable climate; 2. Abundance of good timber; 3. A sufficient amount of cheap labor; 4. Numerous intersecting creeks and rivers to float down the timbers; and lastly a safe and eligible port for their shipment.

It is quite in vain for visionaries or enthusiasts to call attention to vast forests of stately timber, existing in regions where these essentials are not co-existing; for every man who has had any experience in such matters knows full well the numerous difficulties that beset the labours of timber-cutting gangs.

Leaving then all the beautiful and undoubtedly valuable woods which have their *habitat* in impracticable and impossible localities, I shall bring before you those that are easy of access, and that may be transported with facility to eligible sea-ports.

Confining myself to those woods which are, or which may yet become, first class on Lloyd's books, I will first present to your notice the extraordinary capabilities of Honduras.

Even before the time of the celebrated Dampier, the cutting of logwood and mahogany had become an important business in that colony. More than 180 years have since elapsed, and still it is almost wholly known to the world for its large exports of mahogany and logwood, and for these only!

During this long series of years, Honduras has had its organised bands of wood-cutters, whose peculiar occupation has descended from father to son through so many generations, that it has become a part and parcel of their very natures. From childhood to the grave, the sole business of their lives, is hunting for, and cutting timber in the dry season; floating it down to Belize during the rains; and enlivening that seething town with their fantastic dances and drunken revels, until their money being exhausted, they once more are obliged to betake themselves to their occupation in the dense forest. Hard and laborious indeed is their life in the bush; the felling and squaring up of the vast logs of mahogany being really the lightest portion of their task;—for they have to clear away the thick and thorny underwood, cut down and remove thousands of immense trees, in order to form roads, whereon their trucks can pass with their heavy loads to some creek or river. These main and bye roads, are often miles in length, all carefully graded and rendered complete by numerous temporary bridges, strongly constructed. To make these roads and bridges, a party of 50 to 60 men are detached; whilst the remaining number are preparing the mahogany for trucking.

Such gangs are usually provided with from 6 to 10 ponderous trucks, having 14 oxen to each truck; and as these work only at night by torchlight, we can readily imagine how carefully the roads must be cleared of all obstacles.

When the rains set in, and their logs are floating down towards the coast, these hardy fellows follow each batch in their little pitpans, and exercise all their amphibious dexterity in securing the safe and unimpeded passage of their property.

Now, I have not given you this slight sketch for the purpose of mere amusement, but because I wish in the most emphatic manner to point out the important fact that, in this colony of Honduras we have the largest and most practical body of tropical lumberers that exist on the face of the earth. That there is now exported from that colony about 25,000 tons of mahogany and about 6,000 tons of logwood per annum. That these woodsmen, in the pursuit of these two staple products, continually pass and repass vast quantities of fine and valuable timbers, in every way suitable for ship-building.

The forests in which they live and work contain some of the finest quality timber in the world, and that in extraordinary profusion. I do not pretend to know many of these woods, but the following I am well acquainted with: the greenheart, the live oak (*Bignonia*), and other oaks; the mahoe, the bullet tree, the Neesberry bullet tree, the iron wood, the locust (used for ships' planking and tree-nails), the dogwood, the red pine, the pitch pine, (much superior to that of Carolina and the other Southern States of America) the cedar (*Cedrela odorata*), a light and durable wood, not liable to dry rot nor subject to the attack of insects. The trunk of this tree is 70 to 80 feet long, with a diameter of from 4 to 7 feet

I am sure I need not dwell upon the great value of these fine timber woods, but I must again observe that there are numerous others perhaps equally valuable, which I cannot now enumerate. It is quite clear to my mind that the Honduras woodsmen could realise a very great deal more money, and with infinitely less labour, by preparing for market these timbers than they now do from their mahogany and logwood; but as the gangs are always hired under contract by some merchant or mercantile firm in Belize, it is evident that the initiative must be taken by those enterprising gentlemen. The safest course, perhaps, would be to commence the attempt by combining the two objects; for the same roads necessary for the trucking of mahogany would serve for the transport of the other timbers selected.

There is a distinguished member of this Society, Chief Justice Temple, still residing in Honduras, to whom we are all indebted for the indefatigable exertions he has made to attract attention to the capabilities and resources of this fine colony, and I am sure that his advice in relation to the course I have just suggested would be particularly valuable and instructive.

Guiana is another country from which we may reasonably anticipate a very much larger supply of timber than we now obtain. Already it furnishes two out of the eight first-class woods recognised by Lloyd's, viz, the mora and the greenheart; but there are in the country several other most valuable timber trees, such as the kakaralli, the locust, the cabacalli, the bullet tree, the sewari, the carana or red cedar, the kuraki, the determa, the cuamara or tonka, &c., &c.

If well-directed efforts were, however, made to increase the supply of the greenheart and the mora alone, immense quantities of both might be obtained. Greenheart is very abundant within 100 miles of the coast, and can be had almost to any extent, but the mora is even still more abundant. "This most majestic of all the forest trees of Guiana towers above every other, often attaining a height of from 100 to 150 feet, the lowest branches being 60 feet from the ground. The wood is extremely tough, close, and cross-grained, so that it is difficult to split, which renders it peculiarly adapted for ship-building. The trunk makes admirable keels, timbers, and beams, and the branches, having a natural crookedness of growth, are unsurpassed as knees. Were men-of-war ceiled with this wood, little mischief would be occasioned by splinters during action. In most respects it is superior to oak, particularly in its exemption from dry-rot. It is abundant along the rivers of the coast region, and extends as far south as lat. 3° N. It grows luxuriantly on sandy reefs, and on tracts of barren clay, known as 'Mora clay,' a soil so sterile as not to admit of profitable culture."

Sir R. Schomburgh, referring to this tree, says, "In all my former travels in Guiana I have nowhere seen trees of this description so gigantic as on the land adjoining the Berima at its upper course. On this upper part of the river the Mora is so abundant, and grows to such a size, that the whole British Navy might be reconstructed, merely from the trees which line its banks; a circumstance well worthy of consideration, for the river being navigable for vessels of 12 feet draught, those intended for the transport of the timber might load at the very spot where the trees are cut down."

There can be little doubt, then, that these two famous woods can be obtained in quantities limited only by the supply of labour that can be applied to this particular pursuit. Unfortunately labour is both scarce and expensive in Demerara, presenting an obstacle more difficult to surmount than may be imagined.

I am not quite sure that it would not be a good plan to induce the immigration of 100 Honduras wood-cutters, and establish them on some choice timber locality, so that whilst they are pursuing their accustomed labour, they might gradually draw around them those wild and adventurous spirits, who would prefer the excitement of such a life to the dull monotony of a sugar estate.

I do not believe that any great increase in the exports of timber can be anticipated from India Proper; but I think that the exertions of Government might induce a very large supply from Assam. I have in my possession various lists by Dr. Wallich, Mr. Masters, Major Hannay, and Mr. Martin, of the timber woods of Assam, amongst which we find a light and valuable kind of teak, the saul (*Shorea robusta*), the Dalbergia Sissoo, the oak, and numerous others most important and valuable. Assam has the most complete water carriage (the Calcutta steamer even going up to Gowhatti), and a population whose habits are well suited to such an employment as woodcutting; so that if proper measures were adopted, an immense quantity of first quality timber might be annually sent down from this rich country.

The Tenassarim provinces are perhaps more abounding in fine, valuable timber for shipbuilding than any other country in the East.

A quantity of teak has, for many years, been exported from Moulmain and other ports along the coast; but the field which this healthy and most pleasant country still presents is so inexhaustible, that I consider it to stand unrivalled as a timber-producing country. Hitherto teak alone has been exported, but there are others which are considered quite equal, and even superior to it. The following list of some of the best timber woods will serve to give an idea of the capabilities of these neglected provinces.

Anan.—One of the hardest and most compact woods known.

Ahnaun.—Strong and very durable; used in shipbuilding.

Keoun-lae (*Rottlera*).—Excellent for rudders.

Kat-wat-nu (*Cedrela*).—Large timber, 40 to 70 feet long, used for shipbuilding.

Ka-nyeng-kyaung-khyay.—For shipbuilding; contains an aromatic oil, and is not attacked by insects.

Kyep-yo.—Similar to teak.

Kud-doot-alain.—A large tree; used in shipbuilding.

Kunnazoo.—Very large tree; very hard and durable timber.

May-maka.—Used in shipbuilding.

May-rang.—Said to be very durable.

May-tobek.—Used for the bottoms of ships; considered preferable to teak.

Mayam.—An indestructible, strong, heavy, dark red wood.

Podauk.—A beautiful, compact and hard wood, sometimes called "Rosewood."

Pengadoh.—Strong and durable.

Pien-mahne.—Yields very strong knee timber.

Pyan-ga-dean.—Hard, dense, and durable; called "iron wood."

Soondra.—A very tough, elastic wood; said to be the strongest of all the Indian woods.

Thab-ban.—Fine solid timber, sometimes 70 ft. long; used for boats.

Than-kya.—A species of wood similar to saul.

Tha-nat.—A kind of grey teak.

Tha-nat.—More resembling saul.

Than-that.—A capital wood, like saul.

Theet-ya-han.—A species of teak—close grained.

Theng-gan.—(*Hopea Odorata*). An enormous tree, of the saul tribe; yields a strong, compact, and excellent timber, considered superior to teak—also a quantity of good dammer, or resin. Insects never attack this wood, nor is it liable to rot.

Tirbbac (*Quercus Amherstiana*) an oak; a large tree, used in boat-building.

Thounsanga.—A large tree, used in boat-building.

Thingan-kyaup.—Close grained, strong, heavy wood; used in ship-building.

Thubbae (*Mimusops*).—Used in ship-building.

Thuhbor (*Uvaria*).—A large tree, used in boat-building.

Toung-byeng.—A kind of red saul.

Thym-bro.—Good strong, durable wood; used in boat-building.

In this list I have mentioned but a few of the truly valuable timber woods abounding in the provinces of Amherst, Tavoy, and Mergui; and it must be understood that I have not included the well-known teak, which has so long been the grand staple product of the country, although enormous quantities of this celebrated wood yet remain.

Under the old system of the East India Company, the "rules and regulations" for teak cutting were stringent enough, but were rarely acted up to. Licenses were granted only on the conditions, first, that the selected trees were to be barked all round, so as to kill them, two years previous to their being felled, in order that only seasoned wood should be sent to market; and secondly, that for every tree cut down, another young teak tree should be planted carefully out, for the benefit of the country hereafter. I do not know whether these "rules" still continue in force.

It will be seen that timber cutting, therefore, has long formed one of the most important occupations of the people residing in Tenassarim, but we may go very much further than even the knowledge of this fact would lead us, inasmuch as we may view the Muggs, the Taliens, and the Burmese, as being all more or less expert in the use of the axe and the adze; as well as in the knowledge of the various qualities and uses of their forest trees.

There would be no difficulty, then, in organizing large bodies of these men, as "timber gangs," their wages being 10s. a month; but, as these provinces are scantily populated, any additional number of men might be procured (if necessary) either from among the Hill Coles, or from the adjoining territories of Siam, both of whom I have myself largely employed, and can vouch for their being excellent woodsmen. Under any circumstances, these labourers would not cost more than 12s. per month.

On the score of climate, it may be said that there is not a more healthy tropical climate in the world, both for natives and for Europeans. In fact, the late Dr. Helfer, Mr. Riley, and others, long resident in the country, have expressed themselves most enthusiastically in respect of it

The three provinces are thoroughly intersected and opened up, by water communication, for the woodman, by the Great and the Little Tenassarim, the Tavoy, the Ye, the Attaran, the Gyne, the Houndran, the Lenya, the Pak Chan, and numerous other rivers and streams.

Along the banks of these rivers, vast quantities of timber exist, which with the greatest facility may be floated down to the sea.

Amherst offers a tolerable harbour for shipment. Below the town of Tavoy, (to the south of Crab Island,) the anchorage is good and safe in five fathoms of water. The port of Mergui does not itself possess the advantage of deep water, but the other mouths of the Great Tenassarim river are deep and safe; for instance, the Wayaungtaung has six fathoms, with a clear run to sea of not less than eleven fathoms. The Pak Chan has also excellent anchorage in from five to six fathoms.

Along this coast the rise and fall of the tide at full and change of the moon is 18 feet, offering not only great facilities for the egress of heavy laden vessels, but also for the launching of ships built in these provinces.

We find, then, in Tenassarim, combined in an eminent degree all the acquirements for the supply of cheap timber—an abundance of the finest wood—a really healthful climate—complete water communication—and good shipping ports.

In my remarks I have alluded only to the capabilities of the mainland; but it would be unpardonable to omit mentioning the fact that the numerous beautiful islands forming the Merguian Archipelago present advantages of the highest character, and contain harbours scarcely surpassed by any in the world.

Malacca (under which head I comprise our three settlements in the Straits of Malacca, viz., Pinang, Malacca, and Singapore) abounds in valuable timber woods, which are almost wholly unknown in Europe.

My friend Mr. J. W. Westerhout, the Assistant Resident of Malacca (where he was born, and has always lived), has furnished the following list of its principal timber woods:

Tampanees, Blean, Murbouw, Tamboosu, Tampang, Kalat Merah, Madang Katanahan, Natoo, Galam Tekoos, Madang Boagah, Rangas, Madang Konjeet, Madang Lawang, Lanioosoo, Madang Paranas, Madang Langadee, Rassaak, Madang Kawan, Madang Samenjaak, Saraya, Marantee, Lida Karabouw, Pisang Pisang, Mangaranan, Pataleng, Madang Taloor, Dalle Dallee, Baloon Ejook, Salomar, Bintangoor, Bonoot, Kampaas, Madang Kaladee, Jalootong, Giham, Paning Paning, Madang Tandook, Sagah, Panagah, Kalat Potee, Pannah, Marsanah, Kalat Lapies, Kledang, Tarantang, Pinang Bahie, Chengal, Brombong, Tolang Daheeng, Chechaar, Menkadoo Ootan, Golam Zekoos, Gombang, Kalaat Merah, and Maraboun Lahoot.

My own experience of these woods (during my residence in the Straits) was principally confined to the following, which I am able to describe and characterise:—

Murbouw.—Very strong, hard, and heavy; used in shipping; not attacked by insects; will last 100 years.

Bintangoor.—Valuable wood for ship-building, especially for planks, masts, spars, &c. It grows in great abundance, especially near Singapore, and is largely exported to Mauritius, California, &c.

Damerlaut.—Hard, tough, and very durable.

Giham.—A pale yellow wood, close-grained, hard, elastic, very durable, and generally used in boat-building.

Tampanee.—Used for house-building; hard, and exceedingly durable.

Tamboosu.—House beams; considered very durable.

Galam Tikoos.—Hard, tough, elastic; used in boats.

Marantee.—Very large; light resinous wood, much used for planking, and in building boats.

The Straits settlements of Malacca although near the equator, enjoy a healthful and salubrious climate, and have an abundant population of Malays and Chinese, whose wages average three to four dollars a month, without food.

The Malays are first-rate woodsmen and boatmen, admirably adapted for such work as procuring timber; whilst Chinamen are most industrious labourers, and extremely enterprising contractors, for all kinds of work. I consider this locality, therefore, as affording a promise of a very large supply of timber, immediately measures are taken to commence the undertaking, for the natives themselves will not be backward in entering into the spirit of the enterprise.

Australia is the next country to which I shall ask your attention, and which already furnishes us with "iron bark," one of Lloyd's first-class woods—a distinction we all thoroughly understand. This vast island is unfortunately extremely deficient in navigable rivers and in water communication generally, and whether this deficiency can in any manner be remedied by the formation of railroads or tramways intersecting the enormous forests of valuable timber that exist (not far inland), is an important question, now occupying the serious attention of very eminent and influential men in our metropolis, and which I shall have occasion to refer to again, although very briefly. Besides iron bark, the only Australian woods that have any classification at Lloyds' are the stringy bark and the blue gum, and these are in the fifth class. For a variety of reasons, however, I purpose confining myself entirely to the woods of Western Australia in its more southern parts. Those especially interesting to the shipbuilder are the tuart, the jarrah, the blue gum, and the morrell. The "tuart" is a noble timber tree, growing in tolerable abundance on the coast, particularly in the limestone districts. Planks are sometimes obtained ten feet wide, and it is said to be peculiarly adapted to the building of ships of war, as it is most difficult to split, and is not liable to splinter.

It is of a very pale yellow or white, and is sometimes called the white *Eucalyptus*. Its timber is curiously cross-grained, and it is hard, tough, and very strong and durable; from which known qualities it will no doubt attain a high rank at Lloyds', and will be very extensively employed in ship-building, provided it can be obtained in sufficient quantities.

The morrell is a large, fine, tree, yielding timbers three feet in width, which has been used as treenails, and may probably become more generally esteemed.

The blue gum (*Eucalyptus globulus*) is an enormous tree, sometimes yielding planks 14 feet wide and more than 120 feet long. It is beginning to be used pretty freely in ship-building, and will, I believe, when better known in England, obtain at Lloyds' a much higher classification than is at present accorded to it.

But it is the jarrah (another of the *Eucalyptus* tribe) that forces itself so prominently and so urgently upon our attention. It has been very generally called mahogany, because one or two of its varieties bear a resemblance to that wood when polished; but when spoken of in relation to ship-building, I should advise its own name being adhered to.

It is very certain that there are many varieties of the jarrah, just as there are of the teak and other woods; and, by bearing this in mind, we can easily reconcile all the apparently conflicting statements in regard to its colour, disposition of fibre, hardness, density, and specific gravity.

Mr. Reveley, an engineer to the Government, speaking on this point, says:—"First, in colour, there is every variety of shade, from almost crimson to reddish brown, and pale brown inclining to white. In the second place, as to grain, there is almost every variety, from the perfectly straight fibre to every species of curl, including the zebra and satin specimens. The length of the stem of this tree, taking the average, may be 65 feet (many being much longer), without a branch or a knot in all that length, and very nearly equal in size all the way up; being veritable ornaments of nature. It is not attacked by insects of any kind, nor has it any tendency to dry-rot, and is scarcely affected in any way by damp or moisture." The truthfulness of this description will be clear to those who will inspect the specimens on the table this evening.

There are forests of this wood (almost wholly) in Western Australia, of more than 4 miles in depth, which are known to extend for a length of 150 miles, covering an area of more than 364,000 acres, containing timber sufficient to build 20,000 line-of-battle ships!

A knowledge of these facts is enough to stimulate enterprising capitalists, especially as this wood is known to be a beautiful and a valuable furniture-wood.

Our merchant ships go out with emigrants and cargoes, but for a *return* cargo, they frequently wait and wait, and wait in vain; it would not be so if these vast forests could be opened up.

No wonder, then, that our enterprising merchants are turning their thoughts to this promising field of operations, and are seriously contemplating the construction of a short railroad (of eight to ten miles), to bring the timber to the shipping point. My own opinion is, that a company should be formed to carry out this important measure, and that Government should aid the undertaking by allotting to that company a sufficient number of selected "convicts" to work as labourers.

It has often struck me, that half the question as to the commercial success of the *Great Eastern* would be answered if she could always be sure of 10,000 to 15,000 tons of timber as freight on her passage from Australia; but within the last month or two I begin to fancy that she may, for the present, more likely be required to bring several brigades of our hot-blooded sepoys to Suez, for service on the shores of the Mediterranean: stranger things than this have happened before now.

In suggesting the means of obtaining larger supplies of ship-building timbers from the East and from Australia, I must make some few remarks on the subject of freight, which I know many might consider an insurmountable expense.

In reply to this, I would ask if ships do not take railway iron for 10s. a ton to India? Secondly, How much per ton on an average do ships obtain for dead weight from India, and how many wait there months for a return cargo, and, after all, come home only half-laden, or else have to run down to Arracan to load with rice for China in despair? On particular emergencies, when India is overwhelmed with shipping, as was but lately the case, ships have actually brought home sugars as low as five shillings per ton freight.

Recently a ship has taken a cargo of jarrah from Perth, in Western Australia, to Colombo, in Ceylon, at 45s. per load of 50 cubic feet freight; and, considering the number of vessels that require something in the shape of freight to pay their expenses homeward, I think that timber at 40s. would prove very acceptable in a majority of cases. On the other hand, I take it for granted that if timber cannot afford to pay at least 40s. per ton freight home, that such timber had better not be sent at all, and I entertain the idea that really good wood can legitimately bear this amount of freight.

The Preservation of Timber-built Ships.

In the former part of this paper I have already touched upon two subjects, which are both comprised in the one important question of preserving ships from the rapid decay to which they are now so liable. I have endeavoured to show where and how a far larger supply of the most durable timber may be had; but, after all, the fact remains patent, that even the best of woods when made into a ship will exhibit decay much sooner than they should do. And why is this the case? In my humble opinion, it is because ship-builders and ship-owners will not adopt the simple but efficacious means which chemical science, confirmed by ample experience, offers them. Long years of practical experiment has shown that timber, however prone to dry rot or to wet rot, may be effectually preserved from both by the use of certain metallic solutions or other suitable protective matters.

Amongst the many, one of the very best solutions for this purpose is that of sulphate of copper, which many years ago was patented by a Mr. Margary. Now this substance is sold, in quantities, at 4d. per lb. So that £100 would buy 6,000lbs., and each lb. weight is sufficient for six to eight gallons of water.

The process of saturation is a very simple one; the timber being placed in a closed iron vessel of great strength, is made to imbibe the solution by exhaustion and pressure, the operation occupying but a few minutes.

Timber so treated is rendered perfectly exempt from all liability to dry-rot; whilst other injections, such as paraffine oil, the commonest and cheapest naphtha and oil, with a little resinous matter dissolved and mixed with oil, will effectually prevent the decay from wet-rot, &c.

These are all such simple, well-known remedies, that almost everybody has heard of them; and yet it is positively true that neither the Admiralty nor the merchant ship-owner has yet built one single ship in which these principles have been intelligently and thoroughly carried out.

A reasoning and an undoubtedly shrewd man of business will have a fine ship built at a cost, perhaps, of £5,000; and yet he will not spend another £200 in rendering her timbers exempt from the attacks of insects and from rot.

But if this indifference be astounding in the merchant ship-owner, how shall we characterise such recklessness when exhibited in the construction of our men-of-war?

Whilst the ship is building it will not do to set boys with mops and brooms to sop the solution on her timbers. Such a mode of operation is not only wasteful and extravagant, but it is indeed playing "mops and brooms" with a very valuable, very beautiful, and very scientific process.

Whilst on this subject I must call attention to some fine specimens (now on the table) of the gigantic pine, which has recently been imported from Vancouver's Island, and to the following letter, which I received from the gentlemen who politely furnished me with those specimens. In this letter you will find that Messrs. Bilbe dwell upon the important circumstance of the gum or resin in these pines being "more uniformly diffused through the wood," thus tending to its impermeability and consequent preservation from decay. This is the chief object we should always strive to attain in treating timbers, with a view to their preservation :—

Nelson Dock, Rotherhithe, London, April 30, 1859.

Sir,—We have been informed that a specimen or two of the wood recently imported by us for mast-making purposes would be acceptable to you; we therefore beg to forward you a slice cut off the side, and a cube of six inches cut out of the heart of one of the masts made by us. From the slice you will find some of the gum exuding, which appears to us to be of a different nature and more uniformly diffused through the wood than in any other variety of pine known to us. It seems to render the tree almost impervious to water, as in dressing the masts they feel quite dry while being planed up, although floating a few hours before. In its growth this pine is remarkable for its straightness and the absence of knots and defects, and for its very gradual taper. In fact the trees grow *masts*, maintaining by nature that taper which experience has proved the best for masts. While all the pieces imported by us are remarkable, some few are extraordinary; one tree is 129 feet long and nearly 40 inches at one-third from its butt, without a blemish in it, and contains over 26 loads of timber. There was another, extraordinary in another way, its length being 118 feet 9 inches, whilst its diameter at the butt was only 15 inches and that at the top 6 inches. This was made into a flag-pole for Kew Gardens, but was unfortunately cut in two by a steamer, while it was entangled with Putney-bridge. * * * This pine grows in the Oregon and Washington territories, and in Vancouver's Island and British Columbia, where some of them acquire the height of 350 feet. It is, as you may suppose, a serious business to get them out of the woods to the water-side. Their importation into this country is a great boon to the Navy and Mercantile Marine. All those ship-owners who have had experience in the China trade, and in that to the north-west coast of America, can appreciate these mast-trees on account of their durability, which is scarcely inferior to that of teak. Those who have not that experience will, we hope, soon ascertain what is for their interest. Yellow pine, out of which masts of any size are usually made, is very perishable, its average durability being under five years, and when to the expense of renewing masts at short intervals, is added the expense of unrigging, taking out and in, and rigging again, besides the confusion and delay incurred therefrom, you will at once appreciate the value of these trees, if their average durability be only twice that of yellow pine. The writer has known them over ten years in a ship himself, and not a symptom of decay; and has been informed, among other instances of durability, that in one of the dock-yards a single bowsprit had worn out two frigates.—We are, Sir, your obedient servants,

THOS. BILBE and CO.

Leonard Wray, Esq.

Time will not permit me to enter more fully into this comprehensive subject of wood-preserving; but I must emphatically and respectfully warn our Admiralty to have every one of the sailing ships which are now being converted into screw steamers, as thoroughly saturated with the sulphate of copper solution as possible; especially in all those parts near the engines, boilers, and bunks. Let it be remembered that those ships were not intended for steamers when built, but that in opening them out for the purpose of lengthening them, opportunities will be afforded for using the preservative solution, which, as far as they are concerned, will never again occur. If this measure be not adopted I feel convinced that dry-rot will speedily destroy these ships, and many hundred thousands of pounds sterling will be lost to this country.

In conclusion, I beg leave very respectfully to suggest that the Council of this Society, in the interest of our naval and commercial marine, do address to her Majesty's Government a request that the Colonial Secretary shall order the several engineer officers residing in Honduras, Guiana, Assam, Tenasserim, Malacca, and Western Australia, to make a careful selection of the best and most durable timber woods of their respective localities, being not less than one or two tons of each timber, to season these lots in the most careful manner in the colony, and when fairly seasoned to send them home to the government dockyards, where they may be examined and tested by a commission composed of duly qualified men.

I believe that such a selection, so obtained, would prove of the utmost value to the government itself, as well as to the country at large, and I venture to think that the Committee of Lloyds' would also view it with great interest, and gladly facilitate the important objects in view.

Our numerous colonial territories possess vast forests abounding in the most durable timbers, which would be of the greatest value to our Royal Navy, and to the shipbuilding community of the United Kingdom, and it is a duty we owe both to those colonies and to this country, to develop their rich resources, and bring to light these almost hidden treasures.

In all such cases as this, there can be only one heart and one mind amongst Englishmen, who are always honourably anxious for the welfare of our country, and for the continued stability of our maritime pre-eminence.

DISCUSSION.

The **Chairman** said that in inviting discussion upon this subject, he was induced to offer one or two remarks, because Mr. Wray had noticed the apparently short period for which Lloyd's Register had given class A 1 to vessels built of the finest descriptions of wood, and he had mentioned the case of the *Gibraltar*, a vessel built entirely of mahogany, which lasted one hundred years. It was true that they assigned a period of twelve, thirteen, or fourteen years, to vessels built of the highest classes of wood; but they by no means limited it to any particular period, because, under certain inspection, vessels were entitled to carry that character a few years longer. But a ship was liable to certain vicissitudes to which other descriptions of buildings were not exposed. They might take the instance of Westminster Hall, in which the rafters had lasted for eight hundred years, and in many cases showed no evidence of decay; but it must be borne in mind that the timber in that instance was not subject to the vicissitudes of climate, or to the action of the weather. A ship was exposed to both of these; at one time she might be England, and in a few months in the tropics. These changes were severe trials to her timbers. Then again ships were subjected to variations in the cargoes they brought; and the want of proper ventilation was another source of dry rot and decay. In alluding to iron-built ships, he would observe that with regard to the large ocean-going steamers there would have been serious difficulty in supplying the enormous quantity of timber that would have been required for their construction, so that here the advantage of using iron was apparent. This material had been hitherto confined almost entirely to these steamers. There were not many instances of sailing vessels built of iron, while in the case of the larger steamers the exception was to find one built of timber. One objection to iron built vessels was that they were unsuited to certain descriptions of cargo. Sugar brought over in them was deteriorated, whilst guano acted injuriously upon the ships themselves. For many years to come, therefore, he thought they might look for a large demand for ship-building timber. He felt greatly indebted to Mr. Leonard Wray for having brought forward this subject; and, speaking on behalf of the society of Lloyd's Register, they would be happy to do anything in their power to further the objects proposed.

Mr. **Varley** called attention to various remedies for dry rot in timber, which during the last fifty years had been brought before the committees of the Society and duly recorded in their Transactions. He considered that in many instances the timber was half rotted by the process of seasoning. The whaling ships had been proved to outlast all others owing to the quantity of oil and salt with which the timber was penetrated.

Mr. E. J. **Reed**, being called upon by the Chairman, said that, although in his judgment it was very undesirable in such discussions as the present, to pass by the main features of the paper read, and direct attention prominently to any incidental remarks which it might contain, yet as he was wholly unable either to add to, or to dispute, any of the leading statements contained in the very valuable paper to which they had listened, and as the author had devoted a paragraph or two to a subject on which he thought it highly desirable that something should be said, he would venture to invite the attention of the meeting for a very few minutes to the subject of iron ships. The author, in the earlier portion of his paper, had said:—"Next to the entire non-existence of a navy, I can conceive of nothing so perilous to the interest and safety of this country as having our ships of war constructed of iron. Nor can I, at present, conceive how the inventive faculties of man—aided by all the science of the age—can afford any adequate safeguard against the disastrous liabilities of a thin iron structure, such as a ship exposed on the ocean, to the terrible effects of a cannonade." However unfit the iron ships which had hitherto been constructed for war purposes might have proved, we were undoubtedly about to return to the use of iron in the construction of such vessels. It would be in the recollection of gentlemen present that nine or ten weeks ago Sir John Pakington announced in the House of Commons that, whatever might be their cost, we had no option but to commence the construction of iron-coated vessels. The reason alleged by him for this was two-fold; in the first place, he said, the experiments made with Sir William Armstrong's gun had shown that thick iron might be employed with advantage as a defence for the sides of ships; and in the second place the French had two ships thus defended fast approaching completion. Since that speech of Sir John Pakington's was made, a report made to the Treasury in January last had been received, from which he (Mr. Reed) derived the authority to state that the French were then actually preparing four of these iron-sided vessels. These vessels, it was stated, were to be substituted for line-of-battle ships. Their timbers (for they were built of wood) were of the scantling of a three-decker. They were to carry 36 heavy guns, most of them rifled 50-pounders, which would throw an 80-lb percussion shell. The Report stated that the naval men of France seemed to be so convinced of the irresistible qualities of these ships that they were of opinion that no more ships of the line would be laid down, and that in ten years that class of vessel would have become obselete. We had still further information to the effect that no less than eight of these ships were in contemplation by the French Emperor, the construction of six of them being fully determined upon. These vessels would not prove very efficient ships in many respects. With engines of 900 horse power only, they could not be very fast; nor could they be expected to prove very handy. But the important fact to be observed with reference to them was, that they might fairly be expected to be found proof to both Paixhans and Armstrong shells, and those present might judge for themselves what would be the effect of half-a-dozen shell-proof frigates making their appearance among a fleet of our wooden ships. In order to avert such a disaster as this Sir John Pakington had obtained a grant of money from the House of Commons to enable him to build a few shot-proof ships for our own Navy, and had called upon private ship-building firms, and also upon his own master shipwrights, to furnish designs for such vessels. As soon as these designs were received, if not before, it became perfectly evident that the most efficient method of constructing the shot-proof frigates would be to build them wholly of iron. This had been fully decided upon. He believed the main reason of this was to be found in the fact that it was not practicable to cover the whole of the exposed portion of the ship with thick iron, on account of the weight, and it would not of course do, in these days of explosive shells and liquid fires, to leave any portion of a wooden ship exposed. Consequently, the resort to iron alone became absolutely necessary. That the uncoated portions of the ship would be open to what Mr. Wray had denominated the "disastrous liabilities of a thin iron structure" was most certain; but the difficulty was got over by so proportioning the volumes of the defended and undefended portions of the vessel that, should the latter become riddled by shot and water-logged, the vessel would still be sufficiently buoyant to float, and maintain the action in which she happened to be engaged. He (Mr. Reed) was very sorry to say the Admiralty had lost time in proceeding with this great and most necessary undertaking. Sir John Pakington had promised the House of Commons that he would not lose a moment in bringing these ships into existence. But two months and more had passed since then, and yet no contract for building a single iron-coated ship had yet been issued. He feared they must impute to the extravagantly imaginative speech of Lord Clarence Paget a part of this delay, for the Admiralty departments had had much to do in the way of vindicating themselves from his unmerited attack. It took much time to go over the ten years' accounts of such a department as the Admiralty. Still, for his part, he thought delay on such grounds was scarcely justifiable. It would be better for such a speech to go unanswered altogether, than to withdraw our strength for months from an undertaking by which alone we could maintain an equality with France. In the hope that his words might find their way into the daily papers, and thus reach the eyes of our government, he had brought this subject to their attention. It appeared to him scarcely fair to this great iron ship-building country, to allow her to fall behind France in this matter.

Mr. P. L. **Simmonds** said, resuming the special consideration of the subject under the aspect in which it was regarded by his friend Mr. Wray, it was one of the highest moment to the country, and a more accurate knowledge of the available varieties and properties of woods suitable for ship-building, and, indeed, for other constructive purposes, was much to be desired. There was a great deal of miscellaneous information floating about, but very little reliable, respecting woods, although there were many small collections with meagre lists belonging thereto. Even with respect to most of the very woods ranked as first-class by the society over which the chairman presided, and largely used for ship-building, scarcely any information could be obtained. Knowing these facts, he had sent in to the secretary, for publication in the *Journal*, a few remarks upon them, supplementary to Mr. Wray's paper. The great difficulty in most collections of woods was the identification of the tree which produced the timber, and the attaching to the specimens the generic and specific name; for it might often happen that a useful wood, sent under some unknown native name from some country, might be more cheaply or extensively obtained in another locality. The numerous woods recommended by Mr. Wray, from his practical knowledge, as obtainable in the Tenasserim Provinces and about the Straits' Settlements fell under this category, that they were not scientifically named. He had frequently extensive collections of specimens of wood sent him by friends from different quarters, from Central America, from Brazil, Ceylon, and other localities, for his own private museum, which merely had local names; and in the absence of bark, leaves, or fruit, it was extremely difficult to refer these woods to their proper natural history classes. A friend of his, the late Mr. R. W. Nash, had introduced and called public attention some years ago to the very valuable woods of Western Australia, and had favoured him with specimens of those spoken so highly of by Mr. Wray. But the ship-builders seemed content to rest upon the woods they at present employed, until possibly, hereafter, greater scarcity of supply would lead to more inquiry into new fields. That our colonies and foreign possessions could supply abundance of fine and durable woods, whether in Honduras, Demerara and Berbice, Australia, Tasmania, New Zealand, Vancouver and British Columbia, there could be no doubt. The questions of labour and freight were the main impediments to the supply. It might, however, be possible to transport labour to the forests, and even shipwrights to the colonies to build the ships on the spot—for shipbuilding was now successfully carried on in India and New Zealand, as well as in our North American colonies—instead of having to bring the timber long distances to our building yards at home. It was very doubtful whether timber could be brought from the antipodes in any quantity at the freight named, and it was not every ship that was suited to carry timber. The vessels that went out with passengers and light goods to Australia and India were not very well adapted for bringing home balks of timber or spars. These, however, were matters for close and practical inquiry. The alleged difficulties of bringing Australian timber to the coast for shipment were no greater than, nor perhaps so great as, those already existing in Honduras, which Mr. Wray had detailed. If roads and bridges were made there, they could also be made in Western Australia and other of the Southern Colonies whence timber was to be shipped. Mr. Reveley and Chief Justice Temple, who had been alluded to, were both members of the Society, and would be able to furnish much practical information with respect to the timber in the districts to which their knowledge extended. Looking to the manifold uses of wood, the more such subjects were discussed the better. The Society had already done much good in the valuable information it had, during a long series of years, accumulated, in its Transactions and *Journal* on woods, and it was satisfactory to find it still devoting its energies to the diffusion of useful information.

Mr. Ditchburn said that the author of the paper doubted the sanity of any one who should attempt to question the excellence of *Lloyd's Register*. For his part, however, he begged to point out that that society was in no way an authorised or legal one. He believed the general impression was, that it was a legalised institution; but the fact was, it was a self-constituted body, which did as it pleased, and nobody was bold enough to find fault with it.

The Chairman said, the society alluded to rested upon public opinion, and by that it must stand or fall. He would add, that *Lloyd's Register* was not now upon its trial, neither was this the proper occasion for the discussion of its merits.

Mr. Ditchburn continued—Though a vessel was constructed of the best materials, if they were not properly put together she would be defective, and therefore the character of a vessel did not so much depend upon the materials used, as upon the way in which they were put together. Mr. Ditchburn was proceeding to argue that some of the regulations of Lloyd's, with reference to certain details in the construction of ships, were injurious, when

The Chairman said Mr. Ditchburn was mistaken in supposing these rules to be imperative, but as this was not an occasion on which he could undertake to defend the rules established by Lloyd's, he thought it better that this subject should not be proceeded with.

Mr. William Hawes was in hopes that Mr. Ditchburn would have grappled with another portion of the subject, viz., the preference which had been given to wood, as a material for ship-building, over iron. He believed it would very much tend to the benefit of our naval and mercantile marine, if, instead of directing attention to the means of preserving timber, which was always more or less liable to decay, they devoted an equal amount of attention to remedying the defects which prevented iron from being used for ships of war. They found that, with the ordnance at present in use, a shot could not only be sent through the hull of one vessel, but would penetrate through two vessels if they were alongside each other; and now it was a serious matter for consideration with what thickness of iron they could protect the ships and render them shot proof. He believed they must look to iron for safety, both for sailors and ships, and he thought greater benefit would accrue from directing attention, not to the means of protecting timber from decay, but of making iron ships safe. The chairman had told them that the large ocean-going steamers were constructed of iron, and the smaller ones of wood. He (Mr. Hawes) believed that they could not build a wooden ship with safety above a certain size. After all, a wooden ship was an aggregation of parts put together with wood and iron united—but which were not so united as to prevent play between the parts; whereas an iron ship was in fact a complete beam of iron from one end to the other—stronger where joined than in the middle of the perfect plate. If properly put together it was an absolute tube, which was the strongest form to resist pressure of all kinds; and the only difficulty was how to render the iron so strong as that it should be invulnerable to the ordnance brought against it. This difference being admitted, the reason was clear why large steamers were built of iron and not of wood. A steamer was subject to strains from which a sailing ship was free; and these were provided against in an iron ship by the perfect connection of all the parts. The objection that had been used against iron vessels—viz., that in one case a cargo such as sugar was injured, and in another case a cargo such as guano injured the vessel itself, was no doubt of some weight in reference to the mercantile marine, but he wished to dissent from that part of the paper which led them to believe that wood alone was the proper material for ships of war. He thought in seeking for fresh descriptions of wood for that purpose, they were throwing their time and attention away. They ought rather to hold out inducements to such ship-builders as Messrs. Ditchburn, Scott Russell, and others, to improve the iron ships, rather than to waste their time in searching for new descriptions of timber.

Mr. Weekes said, with regard to one of the objections to iron vessels, viz , the action upon the compass, he would observe that the accidents which had occurred to those ships had not arisen from the effect of the iron upon the compass, but from want of knowledge on the part of the commanders as to the real nature of that action. If the captain of a ship was acquainted with the principles of magnetic attraction, there was less fear of an iron vessel being in danger than a wooden one; because in a wooden one the action of the iron it might contain was less constant. In the merchant service examinations, it was to be regretted that no account was taken of the principles of magnetism. As far as the construction of ships of war was concerned, they had all along gone upon the policy of increasing their size to an extent which, in his opinion, was injudicious. He doubted whether they had not gone beyond the maximum size, and whether those now being constructed were not too large for warfare. He believed a large number of smaller ships would be more effective, such as those carrying one heavy gun, which raked fore and aft.

The Chairman thought these remarks were a little apar from the subject of the paper.

Mr. Mumford (one of Lloyd's surveyors) could not subscribe to the opinion given by Mr. Hawes, that the iron was stronger at the parts where it was joined than in the middle of a perfect plate. Experiments had proved that there was a great difference between the strength of the plate itself and the points of junction, which were generally the first to give way.

Mr. Leonard Wray, in reply upon the discussion, would say in the first place, with regard to the observations of Mr. Reed, that he (Mr. Wray) had most distinctly said that, for all mercantile purposes, he fully believed in the efficiency of iron ships. The ships which Mr. Reed alluded to were more of the character of floating batteries than ships. When they coated a wooden ship with enormous iron plates, they converted her into a floating battery. Mr. Simmonds had made an inquiry respecting the identification of these timber woods. This was a very pertinent question, for they all wished for some means whereby these woods might be accurately distinguished. Happily, upon this subject, he could refer them to two Museums, one at the India House, under the superintendence of a highly scientific man, Dr. Forbes Watson, who was always ready to afford information; and the other at the South Kensington Museum, to both of which institutions he took that opportunity of returning his grateful acknowledgments for the loan of most of the specimens exhibited in illustration of his paper. There was a difficulty surrounding the subject of the identification of East Indian woods, to which he might with propriety allude, as there was much to puzzle even men of research like Mr. Simmonds; that was, the peculiar manner in which the Tenassarim woods were named. The persons who sent these woods never thought of adhering to a single name, but they gave different names to the same wood. A person residing in one locality would attach to it a Siamese name, while in another locality a Burmese name would be employed. This was the case with some of the specimens now before them. At the Indian Museum, he (Mr. Wray) proposed to endeavour to remedy this in some measure by pointing out to Dr. Forbes Watson the exact character of each wood. The next point was that referred to by Mr. Hawes. He (Mr. Wray) thought he had already said enough to show that he did not intend to convey the idea that he was against iron ships as applied to mercantile shipping; but for warlike purposes, he repeated, he did not believe they were applicable; and he thought experience would ultimately prove it in the clearest, if not in the most disastrous manner. The gentleman who had spoken upon the subject of the compass had misapprehended the manner in which he (Mr. Wray) had alluded to it. He mentioned it merely as one of the old-fashioned ideas of the day—that the compass would not traverse correctly in iron ships; but having himself travelled many thousands of miles in iron vessels, it could not be imagined that he held to that notion. With regard to the size of our war ships, that was not a matter strictly pertinent to the present subject, but he thought small-sized vessels, with guns to fire rapidly, and with great effect, would be beneficial to the naval power of this country. With respect to the relative strength of the parts of an iron-built ship, he agreed with Mr. Mumford, that it was at the junctions the fractures might be looked for. He was, however, gratified to find that a plan of diagonal bracing of iron ships, introduced by Mr. Taylerson, was calculated to give great additional strength. He had no doubt that each successive day would bring forth some improvement which the inventive faculty of man would give to the public, whereby they might add, with increased safety, to our iron-built mercantile marine.

The CHAIRMAN moved a vote of thanks to Mr. Wray for his paper, which was unanimously passed.

The Paper was illustrated by specimens of various kinds of timber from different parts of the world, kindly lent from the Museum at the India House, the South Kensington Museum, and from the private collections of Mr. John Allen, and Messrs. Bilbe and Co.

The Secretary announced that on Wednesday evening next, the 11th May, a paper, "On the Recognition of Music among the Arts," by Mr. Henry F. Chorley, would be read.

The following letters have been received since the meeting:—

SIR,—Information connected with the various colonial and foreign woods, their properties and uses, is of the highest importance to this and other countries, whether it be for ship and boat building, furniture solid or veneered, house-building, or the more ordinary carpentering purposes, carriages, implements, and the thousand and one uses to which wood of different kinds is applied. I have from time to time kept my attention directed to this subject, and have endeavoured to diffuse, through the means of the different publications I am identified with, some little practical information on the subject. But an individual, unless supported by Government influence or other resources than private means, can do little in this matter from the limited funds at his command, the time required for research, the expense of publication, and the comparatively small circle of persons specially interested in the fruits of these researches. The Society of Arts has already done much in this wide field, by the collection of information and specimens of wood, and there are now several other labourers in the field accumulating information which will, no doubt, be eminently useful. There are at present very fair collections of foreign woods at the Crystal Palace, the East India Museum, South Kensington, and Kew. There is a small collection at the Admiralty, Somerset-house, which ought to be much enlarged and better known. I am not aware what collection Lloyd's has, but Mr. W. W. Saunders, one of the Committee of Management, and a member of our Society, has a large and well-named private collection. The necessity for some public information on the principal woods is the more necessary, since there are some selected and approved by Lloyd's Committee, of which little or nothing is really known out of the circle of a few shipbuilders.

The importance of a correct knowledge of the qualities of the woods now used or available for ship-building to a maritime nation like Great Britain, no one will deny. We cannot always be restricted to the limits prescribed by Lloyd's, for as some become scarce or unattainable, others must take their place. Very good ships are now launched in North America, India, and the Baltic, although they may not be equal in durability to those built under the superintendence of Lloyd's surveyors, nor are the shipwrights there restricted to the woods which are considered the *sine qua non* to entitle vessels to take rank for insurance under certain grades.

I think it may be well to pass under notice the chief woods bearing a high character with the Committee of Lloyd's register.

Of the English oak little need be said.

The African oak is not an oak at all, but sometimes termed teak, and is the produce of *Oldfieldia Africana.* The imports of late years from Sierra Leone have been declining. In 1841 we received 13,127 loads. In 1853, 1854, and 1855, the imports exceeded 7,000 loads per annum, but since then they have been less than 5,000 loads. As it is now obtained from the interior, every succeeding year it is becoming more scarce. The oaks of America are generally very strong, but some of them are cross-grained and liable to warp and crack under changes from moisture to dryness. That principally used for ship-building, and reckoned a first-class wood by Lloyd's is the live oak (*Quercus virens*), the hardest and densest of the genus. It grows in the Southern States near the sea; and the sea air seems necessary to its existence, as it is rarely found more than fifteen or twenty miles in the interior. The rings of annual growth are very faint, adding to the density of the fibres; the medullary rays are very distinct, traversing in strong pale lines the faint waves of annual growth. In the United States Navy, all the frames and principal pieces are made of it; vessels built with oak, cut on the coast of Georgia, thirty years ago, are now in excellent condition.

Looking at the immense mercantile tonnage of the United States, which equals, if it does not exceed our own marine, it would be desirable to ascertain the character and proportion of the wood used in the construction, and the duration of the vessels, under the more free system of building which prevails there.

American white oak (*Quercus alba*) has not a very good reputation in England, for the reason that the wood generally introduced here is from Canada, and this is never used in America except for inferior purposes. The white oak from the sea-board of the Middle and Southern States is equal to the best foreign timber, and is used for keels, side-timbers, and planks of vessels, and other purposes requiring great strength. It is allowed in the eight years classification of Lloyd's.

The American larch called Hackmatack and Tamarack (*Larix Americana*), is a very heavy, compact, strong, and durable wood, surpassed only by the oak. It is much used in ship-building, especially for knees and beams, and will outlast even oak itself. It is so compact as to be nearly incombustible, unless splintered. It is only admitted by Lloyd's to the seven years classification of ships, and the committee seem not to be aware that the two names are applied to one and the same wood. There is also some confusion about the cedars recognised by Lloyd's, which is the "red cedar," and which the pencil cedar. The red cedar of America is the *Juniperus virginiana*, and the same name is given to the *Juniperus Bermudiana;* both are used for making pencils. Surely, therefore, some more broad distinction for the guidance of shipbuilders should be given, for the pencil cedar classes ten years, and the red cedar but nine years. So with the term juniper, what wood is intended by this. The red cedar of the United States is remarkable for the durability of its wood, the agreeable aromatic odour preventing the attack of insects. It is highly esteemed by ship and boat-builders.

For the purpose of ship-building, teak is well-known to be a rival to English oak, and superior to it in some of its properties. Its durability under exposure to all varieties of climates is perhaps unrivalled, for ships constructed of it have been known to sustain a degree of service which would have knocked up any other vessel. It is also more free from the gallic acid which causes oak to corrode iron and attract worms.

Our supplies of this useful wood are rather on the increase, for we received in 1857, 26,748 loads from India, a considerable excess over any former year. The *Morung Saul* of Lloyd's is difficult to identify, being merely a variety of the *Shorea robusta.* This is unquestionably the most useful known Indian timber for engineering purposes, and is now much used there for railway sleepers. It is not however suited for planks, as it twists, shrinks, and warps, whenever the surface is removed, even after many years seasoning. From some experiments made in India, it appears that, compared with teak, its strength is about 1,121 to 869. Major H. Campbell found that unseasoned saul broke with a weight of 1,308lbs., seasoned saul, with 1,319lbs., and teak with 1,091lbs.

The greenheart of Demerara (*Nectandra Rodiœi*) is a fine grained hard wood, well adapted for the planking of vessels, and being well suited for resisting tensile and compressive strains, is used for the keelsons of ships and beams of all kinds. The black greenheart is considered more durable than the common greenheart.

The mora is another valuable South American wood, obtained from the *Mora excelsa*, a tree which in Guiana frequently reaches 100 feet in height or upwards. It is tough, close, and cross-grained, and is peculiarly adapted for ships' timbers and planks, for which purpose it is extensively used, and reckoned as one of the first-class woods by Lloyd's.

The iron bark of Australia is the produce of several undefined species of *Eucalyptus*, which supply first-rate durable timber; but the timber, I believe, is often confounded with the blue gum obtained from other species of the same family of trees. These are the eight principal woods recognised by Lloyd's for the floors, futtocks, toptimbers, keelsons, and stern posts, &c., of ships.

Among other second-class recognised woods are the Sabuca of Cuba, the produce of *Acacia formosa.* This is a hard and tough wood, of a dull red colour, and close short grain. It is an excellent wood for beams and planking in ships, and is much approved in the Government dockyards. It was used for the steps in the Crystal Palace in Hyde-park, and the same steps are still in use at Sydenham, without any evident signs of wear.

Angelly is a Cochin wood, the produce of *Artocarpus hirsuta.* Venatica I do not know, nor can I find any reference to it, even in the collection of woods named in the Jury Reports of the 1851 Exhibition, nor in any of the few works treating of woods. It therefore proves the want of a handbook of reference on the various woods, and their special qualities and uses.

The tonnage built and owned on the other side of the Atlantic has gone on increasing largely for many years past, and some very fine clipper vessels have been launched, which, for strength and sea-worthiness, will equal any turned out of our building yards.

Capt. De Belveze, of the French Navy, in a recent report to his Government, states—"I visited some of the ship-yards of Quebec, and had conversations with several of the builders. Oak, elm, and cherry, for the planks of the 'live' works; red and white pine, for the planks of the 'dead' works; oak, elm, and tamarac, for the knees; and beech for the ribs; these are the kinds of timber most employed. Mr. Gilmour, the most extensive ship builder in Quebec, does not think that planking and lengths being made of resinous timber would shorten the duration of the vessels, and he observed to me, what was confirmed by other builders, that the tamarac was not subject to dry rot, and was substituted with very great advantage for oak in the knees. He has constructed, in this manner, more than a hundred ships, of from 1,000 to 1,500 tons, which have all done very satisfactory service."

I am, &c.,
P. L. SIMMONDS.

8, Winchester-street,
Pimlico, May 4, 1859.

Sir,—Having attended the meetings of the Society of Arts by permission of a member, I had much pleasure in listening to the able paper by Mr. Leonard Wray, read last evening.

Had I been aware at the time that other than members were permitted to take part in the discussion, I should have undoubtedly asked one or two questions; for, valuable as the paper was as to pointing to sources of supply of timber, as one who has worked many hard woods at present imported into this country, and who knows the difficulties which attend the working of others, it appears to me that capitalists should not be misled. Mr. Wray spoke of several gigantic trees, some yielding planks 14 ft. broad. He also called special attention to the Jarrah, a wood of great beauty and density. Now both measurement and density involve fitness of tools to cut and prepare the timber for shipment; and, as far as I know, a modification in the form of our present tools, in order that we may work these woods economically, would be required. It appears to me that unless Mr. Wray is aware that such modified cutting-tools have been prepared, so as to enable the woods he points out to be worked economically, merchants and traders will be misled by the examination of mere museum specimens; and should they import them, unless they are capable of being worked with existing tools, it is needless to say that there would be great difficulty in finding a ready and remunerative sale for them. Possibly, Mr. Wray can point out the peculiarities in the methods employed by the cutters of India, Honduras, and Australia, and the instruments used; by so doing he will add to the obligation he has already conferred in contributing so valuable an amount of matter through your Society to the public. If tools have to be invented, and exported to foreign countries to work the woods, this will, I fear, add much to their first cost, and tend to impede their introduction into this country.

I am, &c.,
J. G. HOWARD.

Bow, May 5, 1859.

WATER GAS.

The production of hydrogen gas by the decomposition of water is well-known, but for illuminating purposes it is equally well-known that the flame from pure hydrogen alone is worthless, though for heating stoves it has been successfully applied. When jets of lighted hydrogen are made to burn in a grate filled with loose fragments of platinum foil, a very cheerful-looking fire is produced, and this is well-known to the public under the name of Bachhoffner's Polytechnic fire, from its frequent exhibition a few years since at the Polytechnic Institution, by Dr. Bachhoffner. Hitherto the expense of producing hydrogen gas for heating purposes, has prevented its being manufactured on a large scale. Many patents have, however, been taken out during the last few years, for producing hydrogen gas from water, and bringing it into combination with rich gases derived from oil, resin, tar, naphtha, Cannel coal, and other materials, yielding highly illuminating gases. Among those who have been working in this direction, and have taken out patents for effecting the purpose, may be may be named, Donovan, Louz, Manby, Val Marino, Radley, White, Croll, Webster, Barlow, Gore, &c. The processes described by these gentlemen do not differ greatly, but almost the only one which appears to have been carried out practically on any tolerably large scale, is that of Mr. White, under whose patent several towns in the north, and factories in Lancashire, have been lighted with gas manufactured from water, combined with the gas from resin or Cannel coal.

Some small works have been erected at St. Ives, on Mr. Webster's patent. Dr. Frankland, at Manchester, made a large number of experiments in reference to this gas on works erected by Mr. White, at the mills of Messrs. Clarke and Co., with a view to ascertaining its illuminating power and its cost as compared with that derived from coal. The result of these experiments was in favour of the water gas, both as to illuminating power and cost. Notwithstanding this, from some cause or other, its use has not extended.

It is unnecessary now to say more in reference to this mode of utilising for illuminating purposes the hydrogen gas derived from water, as the object is now to call attention to a mode of producing hydrogen gas from the decomposition of water, rendering it applicable for illuminating purposes without combining it with the gases from resin, Cannel coal, and other substances. Mons. Gillard, some years since, turned his attention in this direction, and took out patents for obtaining hydrogen from water, which he used both for heating and illuminating purposes, the light being produced by burning the hydrogen beneath a cap of platinum wire, which thus heated to incandescence, gave a brilliant light. M. Gillard has since been engaged in perfecting his invention, and has lately taken out patents for his improvements. He has erected some small works at Highgate, where the the process is now carried out, and some of the public lamps in the neighbourhood are lighted on this principle. The method adopted at the works is as follows:—Steam from a boiler is carried through pipes, in which it becomes superheated, whence it is carried into iron D retorts, and dispersed over layers of incandescent charcoal by means of a number of small orifices in tubes running through the length of the retorts. The object is to disperse this superheated steam in as finely divided a state as possible over the heated charcoal. The gas thus produced, after passing the hydraulic main, is conducted through the condensers into a lesser purifier, where it becomes deprived of its carbonic acid, and enters the gas-holder for distribution as nearly pure hydrogen. In this state it may be used for heating purposes, but for illumination the gas is made to pass through an argand burner, with more numerous and smaller holes than are ordinarily used for other gas. This burner is surmounted by a cage or net-work of moderately fine platinum wire, fitted to it in such a manner as to stand a little above the dull flame of the hydrogen. This cage of platinum, as soon as the gas is lighted, is converted into a cylinder of intense white light over the surface of the platinum. The light is stated to be perfectly pure, and from the nature of the arrangement is necessarily steady. The inventor states that the gas can be manufactured at a less price than that from coal, and the small amount of platinum used for the burner adds but little to its cost. The City of Narbonne is lighted with this gas, and M. Gillard is under contract for three years to supply the public lights there, about five hundred in number.

Home Correspondence.

TRADE MARKS.

Sir,—Allow me to call your attention to the annexed paragraph, from the second report of the Commissioners of Her Majesty's Customs, commenting on the objectionable practice of importing foreign goods with British marks, which bears so directly on, and illustrates so forcibly, the paper on "Trade Marks" which I had the honour to read to the Society. I am, &c.,

LEONE LEVI.

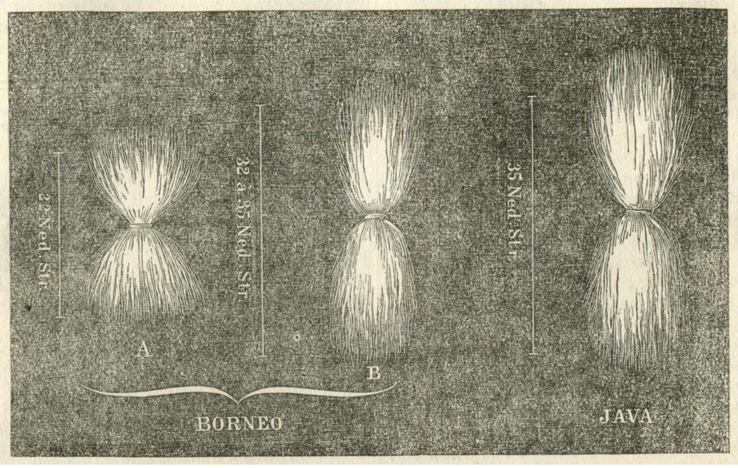
20, Thornhill-crescent, 26th April, 1859.

"It may perhaps be desirable to call your lordships' attention to the increase of a practice which has prevailed to some extent for several years—the importation, or attempted importation, of articles manufactured abroad, but purporting to be British, which, by a strict intrepretation of the law, would be altogether prohibited. In dealing with these cases, our principle hitherto has been simple and uniform, and, we believe, just. The law cannot, either by sanction or connivance, permit itself knowingly to be made a party to a fraudulent transaction, whether the fraud be perpetrated merely on the general public, or on an individual manufacturer as well. When, therefore, dutiable articles are imported bearing marks, brands, or words obviously designed to give them a British character, and to deceive the purchaser into the belief that they are of home production, we decline to admit them to entry, and require them to be returned to the port of shipment, except when neutralised by the introduction of a foreign word. In those graver cases where the articles bear in addition the actual name of existing and well-known British manufacturers of similar goods, we confiscate and destroy them, because the fraud admits of no excuse, and approaches to the character of forgery. Thus, a knife stamped 'Cast Steel, Nuremberg,' would be admitted to entry, because the English words are held to be descriptive only, and to be neutralised and rendered innocent by the accompanying foreign name, 'Nuremberg;' but a knife marked 'V.R., Sheffield,' with a crown, would be sent back to the port of shipment, because, while actually of foreign make, it distinctly purports to be of British origin. And, further, a knife bearing the brand 'Rogers, Sheffield,' would be confiscated and destroyed, as being undeniably designed at once to cheat the purchaser, and to injure the individual whose name it falsely assumes.

"It has, however, of late years been by no means uncommon among British manufacturers, especially producers of clocks, watches, pencils, steam gauges, and various articles of glass, to get their articles made abroad, where labour is cheaper than in this country, and to import them stamped with their own names or distinguishing brand. In these cases the articles are admitted to duty on the application and declaration of the manufacturer. This practice seems greatly on the increase. The instances of it on the part of London alone stood, in 1855, 28, in 1856, 109, and in 1857, 195. In the outports during the past year the instances of similar importation were 150. We do not wish to offer any opinion either as to the practice itself or the continuance of the Treasury order which permits it. We merely desire to signalise its increase to your lordships, and to suggest for your consideration whether the British manufacturer is not thus enabled himself to practice a fraud upon the purchaser analogous to that from which the law protects him when meditated by others. At all events, it seems right that the public should be made aware that the fact of any article bearing a British maker's name no longer affords any security that it is actually of British workmanship."

COTTON IN INDIA.

Sir,—I read with very much satisfaction the paper of Dr. F. Forbes Watson, "On the Growth of Cotton in India." I beg to offer you the drawings of some cottonsamples from our possessions in India, to prove how the staple of Indian cotton could be improved. The sample A is the native cotton from Bangermassing, in Borneo, natural size; B, the staple of cotton cultivated at Mocara Enim, in Borneo, from seed originally Georgia Sea Island, but from the Algerian crop, similar to what was exhibited at Paris in 1855. The other is from the same Algerian origin, cultivated at Buitenzong, in Java. The measure indicated is in millimètres, being 25·4 = one English inch.—I am, &c.,



S. BLEEKRODE.

Delft, Holland.

FREE LIBRARIES.

Sir,—I have read the various letters by Mr. Blake upon "The Society of Arts Examinations," and agreeing with him in some things, and differing in others, saw no reason for interference whilst the letters were confined to their professed object. But when Mr. Blake assails "Free Circulating Libraries," and treats us over again to the old voluntary educationists' arguments, it is time for the suggester of the first Free Circulating Library in England to speak.

I venture to affirm (prior to any specific inquiry) that although we have in this city one central library, with about 35,000 volumes, and several branch establishments, no one of our public educational institutions has decreased in members thereby; whilst the reference departments are fountains, from which the popular writer draws a perrennial supply for the people.

I do not mean to say that there are no borrowers who can afford to pay; but I am certain that great numbers are induced to read good books, who otherwise (if they read at all) would spend their time over the veriest trash; and that working men when out of employ, and with no money to spare, may and do find improving occupation for their leisure, without money and without price.

A taste is by this means created for systematic instruction, which returning prosperity enables the working men to gratify at the Mechanics' or other educational institution.

The tale about the Sheffield Mechanics' Institute would have been startling, had its decline dated simply from the establishment of the "Free Library," but unfortunately, both for Sheffield and the argument, it is much older, and, as I believe, is due entirely to other causes.

The assertion that people value things according to their direct money cost is not true, for what holds so high a place in our estimation as a token of affection or gratitude, even though it would not sell for a shilling. Does the boarding school pupil, at a hundred guineas per annum, value his instruction more than the charity school-boy does that which is the gift of a man who returned to earth about three centuries ago? I affirm, not a whit more.

We have a "model secular school" in this city, the qualification for admission to which is, entire inability to pay anything, and the discipline of that school is as perfect as I ever saw; whilst the attendance is more regular, and extends over a longer period than at any of the working class pay schools.

But even if there was any value in Mr. Blake's argument in this matter, it would not apply to Free Libraries, for where people are taxed for a public institution, they feel that they do pay for it, and therefore ought to value it, whether they do so or not. If this position be not tenable, and as Mr. Blake says, that people value a thing according to the price, how comes he to assert that a Free Library (wanting in this very element of direct cost) injures a Mechanics' Institution, where the members have to pay? And how highly we ought to value an expensive government, and how forcibly to denounce economy.

I am, &c.,
JOHN WATTS.

Whitmore-house, Old Trafford, Manchester, April 20.

Proceedings of Institutions.

Chelmsford Literary and Mechanics' Institute.—The annual meeting of this Institution was held in the Lecture Hall, on the 4th inst., Whitbread Tomson, Esq., the treasurer, in the chair. From the Annual Report and Financial Statement, which was read by Mr. Hair, the hon. secretary, it appeared that the Institution was in a greatly improved condition. The number of members was as follows:—Honorary 25; ordinary 630;—Total 655. The report referred to a handsome donation by Bingfield Baker, Esq., M.P., of £10. 120 volumes had been added to the Library during the past year, making the total number 2420. The average monthly issue of books had greatly increased, amounting to 810 volumes. No alterations had been made in the supply of newspapers and periodical literature, with the exception of the changes made at the last annual meeting, and which have resulted in a saving of £7. The Committee believed their arrangements in the Lecture department had been successful—16 Lectures had been given during the course, and the attendance had never been surpassed. The net cost of the lectures had been £28 2s. 6d. and the Committee appended a statement of the net cost of the last 6 years, to enable the members to judge how far they had endeavoured to secure good lectures at a reasonable expense, showing that the expenses of the last year had been considerably less than for many years past. The drawing class, under the direction of Mr.

Brown, maintained its accustomed reputation. Two prizes had been awarded by Mr. Chancellor and Mr. Moss, and the result of the competition was highly satisfactory. Similar prizes will be again offered, with the addition of one by Mr. hurch. The singing class recently formed, numbering 2 members, was progressing favourably. A class had been formed for the study of Botany, under the superintendence of Mr. John Gibbs, and it is probable that one of the class will offer himself for examination by the Society of Arts. In concluding their Report the Committee drew the attention of the members to the importance of forming additional classes for instruction in the various branches of Science and Art, and urged upon them not to rest satisfied with merely electing a Committee of Management, but to take individually a more active part in promoting the well-being and furthering the objects of the Institution; and believing that the Institution is based upon sound principles, and has already been the means of providing instruction and healthy amusement for a large class of the community, so will it be aided by the exertions of the members calculated to exercise a continually growing and more powerful influence in the cause of education, and on the moral well-being of the locality. The Chairman, in moving the adoption of the report, congratulated the members on the highly satisfactory state of the Institution. Mr. B. Bryant seconded the motion. The election of officers for the ensuing year then took place, and a motion for opening a subscription for presenting the secretary with a testimonial was unanimously carried. Votes of thanks were then passed to the committee and officers for their services during the past year, and the proceedings closed with a vote of thanks to the chairman.

DARLINGTON MECHANICS' INSTITUTION.—In the report for the past year, which was presented at the Annual General Meeting, held on the 11th March, the committee are glad to be able to state that, though no peculiar features of success or encouragement have attended their labours, the various objects of the Institute have been conducted with steadiness and efficiency. The penny bank continues to progress, and gratifying evidences have been afforded of its usefulness. The profits for the past year have been £9 14, and for this handsome addition to the funds the committee are indebted more especially to the secretary and to the cashiers, who have conducted the Bank's numerous transactions. The library has not received so large an addition of new books as the committee would have wished, but owing to the accumulation of periodicals for the two previous years, and the unavoidable deterioration of books in constant use, a considerable sum has been expended in binding and repairs. The total number of books belonging to the institute is 2,613; the issue has been 9,951 against 10,256 in the preceding year, showing a decrease of 325. 21 books have been kindly presented. A new catalogue has been printed. Shelves have been erected for the specifications of patents, which were presented to the Institution about two years ago. The classes have received the attention which their importance deserves. A class for elementary instruction in writing, arithmetic, &c., has been regularly conducted on four evenings of the week by Mr. G. W. Bartlett, with an average attendance of 23 scholars. Mr. William Jones has again kindly undertaken the care of a German class. The superior advantages presented by the Central School of Art having led to the withdrawal of many of the pupils connected with the drawing class, it has now been suspended. Several lectures have been delivered during the session. The soiree held in November last added £8 11s. 11d. to the funds of the institute. The present number of members is 524, being 29 more than last year. The committee record, with deep regret, the death of John Church Backhouse, Esq., who, for many years, held the office of treasurer to this Institution, and took a warm personal interest in its formation. In conclusion, the committee urge upon their fellow members the importance of another spirited effort to remove the debt of £306 14s. 4d. still remaining on the building.

MEETINGS FOR THE ENSUING WEEK.

MON. ......Royal Inst., 2. General Monthly Meeting.
London Inst., 7. Mr. G. W. Hastings, "On Commercial Law, in connection with the Travers Testimonial Fund."
Geographical, 8½. 1. Major Stokes, "Notes on the Lower Danube;" 2. Mr. J. McQueen, "Observations on the Geography of Central Africa;" 3. Mr. Lyons McLeod, "Remarks on the *Seychelles*."
TUES. ......Royal Inst., 3. Professor John Morris, "On Geological Science."
Syro-Egyptian, 7½. Mr. E. Harle, "On the history of Sennacherib; with some fac-simile drawings of the destruction of the Lachish of the Bible, taken from the slabs in the British Museum."
Civil Engineers', 8. 1. Discussion on Mr. Kingsbury's paper "On the Victoria Docks," and upon Mr. Harrison's paper "On the Tyne Docks." 2. Mr. W. Fairbairn, "A Short Account of the Wrought-iron Girder Bridge over the Spey, on the Aberdeen and Inverness Railway." 3. Mr. C. E. Amos, "Description of the Government Waterworks, Trafalgar-square."
Medical and Chirurg., 8½.
Zoological, 9.
WED. ......Literary Fund, 3.
Society of Arts, 8. Mr. Henry F. Chorley, "On the Recognition of Music among the Arts."
Graphic, 8.
R. Soc. Literature, 8½.
Archæological Assoc. 8½.
THURS .....Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."
Royal Soc. Club, 6.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
FRI. ......Astronomical, 8.
Royal Inst., 8½. Mr. W. Hopkins, "On the Change of Terrestrial Temperature at different Geological Epochs."
SAT..........Asiatic, 2.
Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. NO.

Delivered on 6th April, 1859.

140. (1). Electors—Return.
168. Queen's Colleges (Ireland)—Returns.
170. Literary, &c., Institutions—Return.
178. Belfast Lunatic Asylum—Return.
179. Exchequer Bonds—Account.
181. Navy Estimates—Sums required to be voted on account.
181. Army Estimates ,, ,, ,,
185. Revenue Departments Estimates ,, ,,
186. Civil Services Estimates ,, ,,

Delivered on 7th April, 1859.

193. Army—Supplemental Estimate.
182. Navy Estimates (1852-58)—Copy of Report.

Delivered on 8th April, 1859.

133. East India (Mutiny)—Return.
160. Hull Citadel—Return.
99. Bills—Railway Tickets Transfer.
100. ,, Westminster New Bridge.
101. ,, Local Government Supplemental.
102. ,, Pauper Maintenance Act Continuance.
"Charles et Georges"—Further Paper.

Delivered on 9th and 11th April, 1859.

50. Local Acts (49. Isle of Wight Ferry Company)—Admiralty Report
174. Brewers, &c.—Account
175. Hops—Account.
180. Navy (Alteration of Ships, &c.)—Copy of Report.
187. East India—Copies of Financial Despatches.
191. Military Savings Banks—Accounts.
192. Lord's Day Observance Act (Southampton)—Return.

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 29, 1859.]

Dated 7th April, 1859.

865. D. Moseley, Chapel Field Works, Ardwick, Manchester—Imp. in the manufacture of cards for carding cotton and other fibrous materials.
867. R. Postlethwaite, Liverpool—An imp. in harness pads for horses.
869. G. Champney, Halsham, Yorkshire—Imp. in reaping machines.
871. J. Garrett, Arundel-place, Haymarket—Imp. in the construction of goblets, jugs, and other like articles.

Dated 8*th April*, 1859.

873. J. T. Pitman, 67, Gracechurch-street, London—Imp. in the construction and use of fireworks for signals. (A com.)

875. J. Bindley and J. Hinks, Birmingham—Imp. in rotatory steam-engines and pumps, a portion of which imp. may also be applied to the bearings of shafts or axles, and other rotating bodies.

877. M. Wheeldon, 174, Liverpool-road, Burslem, Staffordshire—An imp in looking glasses and mirrors.

879. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the treatment of mineral phosphates of lime. (A com.)

881. W. Hooper, Mitcham, Surrey—Imp. in insulating and protecting telegraphic conductors

883. W. Henderson, Alderley Edge, Chester—Imp. in treating certain ores and in obtaining products therefrom.

885. E. R. Handcock, 23, Norfolk-street, Strand—Imp. in steam and other motive power engines.

Dated 9*th April*, 1859.

887. E. J. Hughes, Manchester—Imp. in the manufacture of woven fabrics. (A com.)

889. J. H. Young, 66, Great College-street, Camden town—Imp. in setting-up (composing) and distributing types.

891. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture or production of the ferrocyanide and cyanide of potassium. (A com.)

893. J. Martin, 4, Buckingham-street, Islington—Imp. in the materials used in the manufacture of bonnet fronts and ruches.

895. W. E. Newton, 66, Chancery-lane—Imp. in steam engines and boilers. (A com.)

897. R. Brown, 5, St. Paul's Churchyard—Imp. in stoves and apparatus for warming and ventilating apartments and buildings.

Dated 11*th April*, 1859.

899. R. Wappenstein, Manchester—Imp. in cop tubes, and in machinery or apparatus for placing the same on the spindles used for spinning and doubling fibrous materials.

901. J. Anderson, Liverpool—Imp. in the construction of the furnaces of bakers' ovens, for the purpose of consuming smoke, which imps. are also applicable to the consumption of smoke in other furnaces.

903. L. Wimmer, Vienna, Austria—An improved preparation for killing beetles.

905. W. Rowan, Belfast—Imp. in spinning flax, hemp, and other fibrous materials.

907. W. S. Clark, Aberdare, Glamorganshire—Improved means of loading ships or vessels with coal, and of separating or removing small coal therefrom.

909. J. Marland, Southport, Lancashire—An imp. in the manufacture of cop tubes.

Dated 12*th April*, 1859.

913. G. J. Johnston, Ashley, Cambridgeshire—Imp. in drills for drilling of corn, seeds, and manure.

915. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of iron. (A com.)

917. C. Burrell, Thetford, Norfolk—Imp. in apparatus for screening corn and seeds.

919. J. Crossdale, Rotherfield-street lower, Islington—Certain imp. in boots and shoes.

921. R. A. Brooman, 166, Fleet-street—Imp. in the preparation of red dyes. (A com.)

Dated 13*th April*, 1859.

923. R. Emery, 6, King-street, St. James's-square—Certain imp. in carriages for common roads.

925. H. Eckhorn, 24, Cranbourne-street, Leicester-square—Improving and regulating the production of light in lamps, to which he gives the name of "universal lamp regulator."

927. J. Apperly and W. Clissold, Dudbridge, Gloucestershire—An improved construction of fulling machine.

929. A. R. Johnson, St. John's-wood—An instrument for damping, severing, and affixing postage and other like stamps.

931. W. A. Gilbee, 4, South-street, Finsbury—Imp. in the construction of the axles of railway and other carriages. (A com.)

933. J. Hughes, W. Williams, and G. Leyshon, Brockmoor Works, Brierley-hill, Staffordshire—Imp. in the manufacture of tin and terne plates.

Dated 14*th April*, 1859.

937. H. C. Coulthard and J. Jordan, Blackburn, Lancashire—Certain imp. in steam-engines.

939. E. Partridge, Stourbridge, Worcestershire—An imp. in the construction of 'pipe' boxes for cart and waggon axles.

941. E. Dowling, Little Queen-street, Holborn—Imp. in parts of scales or weighing machines and in balance weights used for those articles, which are also applicable for other purposes.

943. A. McDougall, Manchester—Imp. in coating metallic surfaces.

945. S. Barnwell, Coventry, and A. Rollason, Birmingham—Imp. in the manufacture of umbrellas, parasols, hats or hat covers, caps, capes, coats, mantles, dresses, gloves, and other similar articles.

Dated 15*th April*, 1859.

947. W. A. Gilbce, 4, South-street, Finsbury—Imp. in the construction of buffers for railway and other carriages, also applicable to other purposes where springs are employed.

949. G. Ashcroft, Cardiff—Imp. in working presses and other hydraulic machines.

951. H. A. Silver, Cornhill—Imp. in insulating wire for electric telegraphs.

Dated 16*th April*, 1859.

953. T. White, Edgbaston, near Birmingham—An imp. or imps. in frames or stands for holding liquor bottles, pickle jars, cruets, and castors, and for holding bottles and vessels generally.

955. L. Collier, Rochdale—An improved feeding apparatus, applicable to grain, loaf sugar, drugs, or other similar materials.

957. E. Newton, 66, Chancery-lane—Imp. in the manufacture of alumina. (A com.)

959. A. Courage, Bagillt, Flint—An improved method of obtaining the metallic particles contained in fumes or vapours from lead and other smelting work.

961. J. Sidebottom, Broadbottom, near Mottram, Chester—Imp. in the construction of tubes and partial tubes, and in machinery or apparatus for placing them on the spindles of machines used in spinning, doubling, winding, and warping; also imps. in machinery for making such tubes and partial tubes.

963. N. Kenward, Sutton, Surrey—Imp. in machinery for obtaining motive power by fluids.

965. W. Walker, Liverpool—Imp. in rocket guns. (A com.)

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

997. L. P. Porter, New York—Imp. in knitting machinery. (A com.)—20th April, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette*, *April* 29, 1859.]

April 29*th*.

2418. J. Wright.
2419. G. Zanni.
2420. R. W. Chandler and T. Oliver.
2422. L. J. Lewis.
2423. J. Morris.
2428. F. Wrigley.
2314. H. H. Henson and W. F. Henson.
2432. J. Dobson and D. Pearce.
2433. J. Cariss.
2491. J. Richmond, J. Quick, and A. Fraser.
2679. C. Parker.
2711. W. E. Newton.
2751. L. Bissell.
2871. A. V. Newton.
235. W. R. Alexander.
237. O. Hussey.
383. J. Evans.
581. J. Fraser.

[*From Gazette*, *May* 3*rd*, 1859.]

May 3*rd*.

2453. V. Blumberg.
2458. J. Fowler, jun., R. Burton, and D. Greig.
2467. R. A. Brooman.
2471. T. Till.
2472. T. B. Smith.
2477. L. Schwartzkorf and F. C. Philippson.
2485. J. Cliff.
2489. J. Jackson, A. Fisher, and J. H. Harney.
2495. J. Wardill.
2510. W. Clark.
2544. J. Benyon and J. W. B. Bowden.
2570. J. H. Johnson.
2595. W. Clark.
2626. J. H. Johnson.
2738. E. Jones.
522. W. Burgess.
530. J. H. Johnson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette*, *April* 29, 1859.]

April 16*th*.

928. U. Scott.

April 26*th*.

1091. L. L. Jardin and J. Blamond.

April 27*th*.

1009. T. Restell.
1020. J. H. Johnson.
1027. W. E. Newton.
1059. A. Chadburn.
1087. A. C. L. Devaux.
1211. C. de Jongh.

[*From Gazette*, *May* 3*rd*, 1859.]

April 28*th*.

1029. H. Mapple.

April 30*th*.

1028. N. Defries and G. H. Bachhoffner.
1033. R. A. Brooman.
1042. W. Naylor.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4165	April 14.	Photographic Portable Dark Operating Tent	William White Rouch	180, Strand, W.C.
4166	„ 20.	Roof Lamp for Railway and other Carriages	Howard Ashton Holden	Birmingham.
4167	„ 21.	Washing Machine and Churn	George Henry Ellis	Malton, Yorkshire.
4168	„ 27.	Parts of an Apparatus to be used in Sowing Mangold-Wurzel or Turnips	John Young	Vulcan Foundry, Ayr.